Essential Components of an Infection Control Program

Purpose:

An infection control program in a long-term care facility provides an internal mechanism to identify and change practices that adversely affect residents' health. The overall purpose of these programs is to improve residents' health outcomes by reducing nosocomial infections. The components include:

1) conducting surveillance of infections or injuries in residents and staff;
2) analyzing the collected information;
3) using the data to provide indications for changing practices or instituting control measures;
4) developing and implementing control measures that reduce infections and injuries in residents and staff; and
5) conducting evaluation of these interventions, making changes if necessary.

Infection control programs are required in health-care facilities by a number of regulating agencies including the federal and state government and the Joint Commission on the Accreditation of Health Care Organizations. The Utah Department of Health, Bureau of Health Facility Licensure requires each regulating health-care facility to have an infection control program including an infection control committee. Additionally, there are several other reasons to have and support an infection control program. A good infection control program protects both residents and employees from infectious complications and maximizes the quality of care provided to residents. Moreover, a good infection control program may help to identify areas in which staff need additional training and identify outbreaks early which helps to limit legal liability for the facility and staff and minimize adverse publicity for the facility.

The Infection Control Committee:

The efforts of the infection control committee and the designated infection control practitioner (ICP) are largely proportional to the success of a program. Members should be interested and motivated to learn more about epidemiology, patient care practices, cleaning and other infection control related topics. Representatives from the administration, nursing, pharmacy, housekeeping, as well as the medical and nursing directors and the ICP are needed to have good representation and functionality.

The ICP is usually a registered nurse with clinical experience and has effective verbal and written communication skills. He or she should be (or be able to become) familiar with laboratory and epidemiological techniques. The ICP should have the final responsibility for the detection and record keeping of infections within a facility. In most long-term care facilities, the infection control nurse is also responsible for other duties. Thus, it is essential for the ICP to have a scheduled time for infection control activities so that other duties do not detract from the infection control program.

Meetings of the infection control committee are usually held every one or two months, but should be held at least quarterly. The ICP or the medical director usually manages the meeting, following an agenda that includes old and new business. Minutes must be taken including a pertinent summation of the discussion and the course of action as decided by the committee. The data collected by surveillance, infection rates and problems are reported to the committee. Preventive efforts and control measures are discussed. Decisions or actions to be taken by the committee should be reported in the minutes which should be distributed prior to the meeting so that they may be approved at the next meeting.

The duties of the infection control committee as required by the Utah Department of Health, Health Facility Licensure Rules for Nursing Care Facilities (R432-150-25) are located at the end of this section (see page 27).

Surveillance Systems:

When designing an infection control program or evaluating an existing program, the surveillance program is an appropriate place to begin. What information is collected? What information is useful? How is it used? Are there implications for prevention? ***The key to surveillance is to collect only that information which is necessary and useful.*** Data should be stored in a manner so that information is easily retrieved and accessible; computers can be extremely useful, although not absolutely necessary. Software such as Epi Info (developed by the Epidemiology Program Office, Centers for Disease Control and the Global Programme on AIDS, World Health Organization) are not copyrighted and can store data in an easily accessible format. However, it is necessary to learn to develop the format of storage so that epidemiological analysis is possible. Depending upon the size and resources of the facility, some practitioners prefer using traditional log books and calculators for the determination of infection rates.

Surveillance of infections/injuries is conducted to provide quantitative information on patients' health and as an indication of the quality of care provided. The entire procedure for surveillance should be written, including definitions of infection and a listing of exactly how surveillance is conducted. Information on how rates are calculated should be included so that personnel changes and absences will not affect the method of surveillance and rates will be determined in a consistent manner.

Many sources of data are available to identify possible infections in the patient population including laboratory and x-ray reports, charts, walking rounds, kardex, treatment book, shift reports, nurses' aides notes and other information sources. It is important to note that each facility may develop their own system of reporting or determining infections. The ICP should then use these reports to verify or reject cases.

Surveillance of infections is not an end to itself. Surveillance is useful only if the data is collected in a consistent manner and follows consistent criteria. In order to be useful, the information gained from surveillance systems must be properly evaluated and used to develop inferences on how to change practices so that patient health is improved.

When conducting surveillance, ***written definitions or criteria for infection are extremely important.*** An example of written definitions for infection in a long-term care facility is located in the reprint of the article entitled "Definitions of Infection Surveillance in Long-Term Care Facilities" (beginning on page 14). By using written criteria for definitions, both surveillance and outcome measures will have consistency. Determining whether a patient's condition meets the case definition for an infection becomes more of an objective measurement than a subjective interpretation. Consistency is important because the rates developed from the data collected through surveillance will be used as an indicator for action by the infection control program.

A surveillance system must be simple, accurate, acceptable, and allow for measurement to be calculated relatively close to the time of infection if needed. However, it is important to note that a surveillance system that works for one facility may not always work in another. ICPs in long-term care facilities should work with their infection control committee to develop or adapt programs including definitions or criteria for infection. The infection control committee should formally adopt the definitions for nosocomial infections used for surveillance. Additionally, when an outbreak is suspected at a long-term care facility, a case definition should be developed using criteria specific to the outbreak.

Various data or "events of interest" may be collected by an infection control program. Generally, the infection control committee or practitioner will determine what data will be collected, (e.g., infections, injuries, needlesticks, exposures or other). Infections of the urinary, gastrointestinal, upper and lower respiratory tracts and skin (including decubitus ulcers and infestations) are usually included in a long-term care infection control program.

Forms and Documentation:

Most often, infections or possible infections are recorded on a form developed for data collection. It may be useful to have many different sources report possible infections in writing to the ICP. The ICP may use these reports to determine if additional investigation is necessary to determine whether a suspect infection meets the case definition for infection.

New practitioners may find it helpful to visit a similar facility to survey another infection control program. Talking to other infection control practitioners about their program is a quick way to gain an introduction to the field of infection control. Look at different surveillance systems, particularly methods of data collection, management and analysis. Ask for copies of written policies and procedures relating to infection control and
standardized forms, formats for minutes of infection control meetings, and other paperwork. If practical, ask permission to adapt these forms for use in your facility.

Calculating Rates:

Assuming that a reported infection meets the definition for an infection when applied to the criteria for the facility's definition, the ICP must then determine whether the infection is ***nosocomial*** or ***community acquired***. This is important; failure to discriminate between these two types of

infections has been identified as a problem in long-term care facilities. Combining these two types of infections obscures the true nosocomial infection rate. *Any type of infection that was present or incubating at the time of admission or readmission is considered community acquired.* Thus, it is very important to document when the onset of signs and symptoms began.

The ICP must provide extensive training to others within the facility, teaching them to report not only suspect infections but specific signs and symptoms as well as the time of onset. Many resources can be consulted if there is a question in the duration of the incubation period for most infectious diseases/infections. A particularly valuable publication is Control of Communicable Diseases Manual, published by the American Public Health Association. For more practical purposes, a general rule of thumb is that if an infection develops more than 48 hours after admission and the incubation period is unknown, the infection can be classified as nosocomial.

The collected surveillance information is used to develop a log of patients with an infection(s), distinguishing between nosocomial and community acquired. The log should be a line listing of all infections with the pertinent patient information such as location of infection, organism, onset, treatment, etc. An example of a line listing is located in this section (page 26).

The information in the log will not give information that can be compared from month to month; since the number of patients (or patient-days) in the facility that month may vary. Thus, the ICP must calculate infection rates which provides an indication for comparison, assuming that the patient severity and mix remain the same. Infection rates may be hand calculated or done using a computer with the appropriate software package. Rates may be calculated for both nosocomial infections and community-acquired infections, although because the long-term care setting is the patients' residence, most infections will be nosocomial.

When beginning an infection control program or instituting new definitions for infection, it is appropriate to conduct total house surveillance for at least a full year. This manual focuses on total house surveillance. Total house surveillance means collecting information on all types of infection within the resident population for the first year. The data collected during this year will allow calculations to be made to determine the ***baseline rate.***

Putting the raw data into a format that can be used for comparison within the facility and that describes the infections within the facility is the responsibility of the infection control practitioner. The information collected on the line listing may be used to calculate various rates to describe data. Incidence rates are typically the most useful for comparison of infection trends within a facility. ***Rates should be calculated at least monthly and data should be collected at least weekly***. In certain instances such as outbreak situations or for reporting purposes or trend identification, the rates may be calculated weekly, quarterly or annually.

When calculating rates, finding the correct denominator can be difficult. Generally, the average of the daily census is used per month multiplied by the number of days in the month to give patient days. However, sometimes, you may be interested in determining rates for specific risk factors and need to limit the population even further. For example, catheter-days are frequently used

as a denominator for urinary tract infections because the presence of a catheter greatly increases the risk of a urinary tract infection. Other risk-specific denominators include device use (number of patient - device days) such as ventilator days, central intravascular catheter days or specific age groups.

Epidemiological Rates

Definition of a Rate: ***A rate measures the probability of occurrence of some particular event in a population. In our case, the event of interest may be an infection, an injury or work days lost. The general definition of a rate is X/Y x K ; where X is equal to the number of events of interest; Y is equal to the number of persons in the population at risk; and K is equal to some constant number such as 100 or 1000. There are many types of rates that are used in epidemiology. For the purposes of simplicity, this resource will focus on incidence, prevalence and attack rates.***

A. Incidence Rate

The most common rate used for epidemiological statistics is the ***incidence rate***. This rate is expressed as the number of infections per person x time; generally is expressed as infections per 1000 resident-days. The incidence rate means the potential for change in disease occurrence per unit of time, relative to the size of the disease free population at that time. This is calculated as:

Incidence Rate = X/Y x K; or

$$= \frac{\text{new infections in a period of time}}{\text{the number in the population for the period of time}} \times 1000$$

For long term care facilities, this is most often expressed as:

$$\text{Incidence} = \frac{\text{new infections in a month}}{\text{average daily census of the month x \# days per month}} \times 1000$$

The incidence rate is usually multiplied by 1000 to give an infection rate per 1000 patient days. For Example: 20 cases of nosocomial influenza-like illness in December with an average daily census of 140 persons and 31 days in the month of December:

$$\text{Incidence Rate} = \frac{\text{20 cases influenza}}{\text{(140 persons)(31 days)}} = \frac{20}{4340} \times 1000 = 4.6$$

which means there were 4.6 cases/1000 patient-days.

B. Prevalence Rate

Another rate that is used in epidemiology is a ***prevalence rate***. The prevalence rate means the number of persons with a characteristic at one point in time divided by the number of persons in the population at that point in time. It can be represented:

$$\text{Prevalence} = \frac{\text{cases at that time}}{\text{population at that time}} \times K$$

The constant K is equal to 100 so that the rate may be expressed as a percent. For example, 5 out of 100 patients have UTI today, therefore the prevalence of UTI is equal to:

$$\frac{5}{100} \times 100 = \frac{\text{5 patients with UTI today}}{\text{100 persons in facility today}} \times 100 = 5\%$$

C. Attack Rate

The ***attack rate*** is often calculated during outbreak investigations; it is a type of incidence rate. The K in an attack rate is always 100 so that it is expressed as a percent of the population being investigated.

$$\text{Attack Rate} = \frac{\text{\# new cases for a specified time}}{\text{persons at risk during that time}} \times 100$$

For example, suppose there are 7 cases of scabies on ward A that have been identified this week. There were a total of 35 persons residing on ward A during that same week.

$$\text{Attack Rate} = \frac{\text{7 cases/week}}{\text{35 persons/week}} \times 100 = .20 \times 100 = 20$$

or 20% of the population was affected in that week

This rate is also used for calculation of rates when trying to identify the food that caused illness when investigating a foodborne outbreak.

D. Endemic vs. Epidemic — Establishing Thresholds

In any population, a certain amount of disease or infection is always present. This is called the ***endemic rate or baseline*** and is the amount of disease/infection one would expect to see in that population. This rate is generally the average of infections by category for the year. Depending upon the duration of surveillance data available, it may be done by averaging infection rates for the same quarter or season for a number of years. The endemic rate can be used to establish a ***threshold*** which is the level of infection within a facility which warrants further investigation. The goal of the

investigation is to identify conditions or practices which transmit infections and to develop control measures to prevent further spread.

Frequently, when there is an increase in a specific type of infection, the ICP through practice and experience, will intervene before the threshold is reached. In some instances, one patient infected with a communicable disease may necessitate special infection control measures. This is the case with airborne diseases such as tuberculosis, and several other conditions (e.g., scabies infestation or MRSA infection) which warrant special infection control measures.

The threshold, which can be determined by statistical methods, should be discussed and approved by the ICP and the infection control committee. Some facilities establish the threshold by adding one standard deviation to the mean of one year of incidence data. However, any outlier or extreme variations in the rates used to calculate baseline data will affect thresholds calculated in this manner. Other times, thresholds can be determined by searching the literature or using rates from similar facilities. There is no one method that should be used and the statistical sophistication of developing thresholds is very dependent upon the resources and needs of the facility.

It is important, however, not to have thresholds too high. Establishing a threshold that will never be reached may look good on paper but will not result in required infection control interventions.

Risk-Factor Adjustment

Sometimes the incidence rate may appear to be high but in reality it is caused by comparing different population mixes— where some persons are more at risk for developing an infection. Two basic techniques that can be used to reduce this internal bias are risk stratification or rate adjustment. Risk stratification focuses calculations on certain populations with particular risk factors, such as age, surgery classification or medical device. For rate adjustment, rates are applied to a standard population so that comparisons can be made.

For instance, since one risk factor for UTI is the presence of a urinary catheter, one would expect to see more UTI in patients with urinary catheters or a higher incidence rate in a facility where many of the patients had catheters. Thus, some facilities use catheter-days as a denominator for infections and use the number of persons without catheters for calculation of a general UTI incidence rate. For further information on age or risk adjustment, consult a basic epidemiological text.

When You Suspect an Outbreak

Through routine surveillance, the ICP looks for ***outbreaks*** or ***clusters*** of infection. An outbreak or cluster may be defined as three or more concurrent or sequential cases of infection with

the same pathogen(s) that are epidemiologically related. Identifying clusters or outbreaks gives the ICP impetus to determine how the organism is being spread and to develop measures to prevent further cases. It is important not to panic and to conduct an epidemiological study in a calm and rational manner. The following steps should be taken if an outbreak is suspected. Remember that preliminary control measures can be implemented at any time during this process and fine-tuned as more information is gathered.

Steps for an Outbreak Investigation

1. Ensure the existence of an outbreak or cluster. Establish or verify the diagnosis of reported cases, identify the agent. Test to determine if the causative agent or organism is the same for all confirmed or suspect cases if possible.
2. Search for additional cases. Evaluate all reported and/or suspect cases of a disease/illness. Suspect cases should be cultured if necessary.
3. Estimate the number of cases including those cases that are confirmed and those cases which are suspected.
4. Orient the data to time, place, and person. Who was the first case? How did the illness move through the facility? For instance, wing A may have had the first few cases. Do the cases have anything in common? Determine who is not at risk? Are there differences between the populations?
5. Formulate and develop a tentative hypothesis which explains your observations.
6. Compare the hypothesis with established facts. Test the hypothesis.
7. Consider all control measures which apply and institute the most appropriate.
8. Evaluate the efficacy of control measures. Have they affected the disease rate?
9. Write a report of the outbreak including a description of the interventions used.
10. Evaluate your efforts.

Resources and Reporting

Many different resources are available to provide assistance during outbreak situations. Medical literature searches on data bases such as Grateful Med or Silver Platter are useful if you have access to a medical library. A literature search provides a listing of current medical research and articles related to the subject(s) chosen. Additionally, other infection control practitioners, the microbiology laboratory and the local and/or state health departments may have applicable information that can be faxed or mailed.

It is important to remember that if an outbreak is confirmed, regardless of etiologic agent, it must be reported to the state or local health department. Reports may be made by telephone or fax. Any outbreak must be reported, even if it is not a reportable disease. When several facilities report a similar problem, articles may be published in the *Epidemiology Newsletter*, and treatment guidelines and/or recommendations may be developed by the state health department in

order to provide assistance to health-care facilities. Moreover, if the outbreak appears to be widespread in the community, other facilities may be notified of the problem (without naming the facility), so that additional cases may be identified early.

Data Techniques — A Review of Basic Statistics

mean - The mean is also called the average. It is symbolized by the symbol $\bar{x}$. It is calculated by summing the values and then dividing the sum by the number of values.

median - The median is the value that appears in the middle of all the values. For instance if you had seven values, place them in order from lowest number to highest number. The median would equal the fourth value, the one in the middle. If there are an even number of values, the median is equal to the average of the middle two values. For example if you have six values, the median is the average of the third and the fourth.

mode - The mode is the value that appears the most frequently.

range- The range is the difference between the highest and lowest number.

n- n is the total number of values given.

Example:

Suppose the incidence per 1000 person-days for UTI was the following by month for last year:

Jan.	5.1	Feb.	3.3	Mar.	4.0
Apr.	4.6	May	4.3	Jun.	3.9
Jul.	8.0	Aug.	4.5	Sept.	4.5
Oct.	9.1	Nov.	3.2	Dec.	5.6

First place all of the values in order from lowest to highest:

3.2, 3.3, 3.9, 4.0, 4.3, 4.5, 4.5, 4.6, 5.1, 5.6, 8.0, 9.1

The ***mode***, or the value that occurs most frequently, is 4.5. The ***median*** is the value that is the average of the sixth and seventh values which is also 4.5. The ***mean*** is the sum of all of the values divided by **n**, or the number of values, so it is (3.2 + 3.3 + 3.9 + 4.0 + 4.3 + 4.5 + 4.5 + 4.6 + 5.1+ 5.6 + 8.0 + 9.1)/12 which equals 60.1/12 = 5.008.

There are 12 values so **n** = 12. The separate values for each month are considered values for x. Another method to express the mean is by the following:

$\bar{x} = \Sigma x/n$ or the sum of all values for x divided by the number of values for x.

How to Calculate the Variance, the Standard Deviation, the Standard Error and a 95% Confidence Interval

Another value that is important is called the ***variance***. The variance, symbolized by s^2, is equal to the sum of each (x value minus the mean) squared divided by the number of values -1 or (n - 1).

$$\mathbf{s^2} = \sum(x-\bar{x})^2 / (n - 1)$$

It is easiest to use a calculator that has basic statistic capabilities which will provide the variance as long as data is entered correctly. Regardless of what method is used, it is important to check your calculations.

Another method to calculate the variance which is easier is the following:

$$\mathbf{s^2} = \frac{\sum(x^2) - n(\bar{x})^2}{n - 1}$$

Following our example:

$$\sum(x^2) = 3.2^2 + 3.3^2 + 3.9^2 + 4.0^2 + 4.3^2 + 4.5^2 + 4.5^2 + 4.6^2 + 5.1^2 + 5.6^2 + 8.0^2 + 9.1^2 = 336.67$$

$$\mathbf{s^2} = \frac{\sum(x^2) - n(\bar{x})^2}{n - 1}$$

$$= \frac{336.67 - 12\,(5.008)^2}{12 - 1}$$

$$= 3.24$$

The square root of the variance is called the ***standard deviation*** which is symbolized by s.

$$s = \sqrt{3.24} = 1.8$$

Standard Error = $\sqrt{}$variance x 1.96 = (1.8)(1.96) = 3.528

95% Confidence Interval =

The Average Incidence Rate ± Standard Error

= 5.008± 3.528 = (1.48, 8.54)

The 95% confidence interval means if you had a way to repeat the same observation 100 times, 95 of those times the results would be in that range. There is a 95% probability that the true values falls

between 1.48 and 8.54, and a 5% chance that the true value is outside of that range.

One method used to establish a threshold is to use the average incidence rate plus 1 standard deviation or using the example: threshold is 5.008 + 1.8 = 6.808. Thus, when an incidence rate appears to reach the threshold, extra evaluation and/or surveillance should take place to look for an epidemiological link between cases so that sources of outbreaks can be identified and control measures for prevention put into place. At times however, through experience and epidemiological reasoning, the ICP will act prior to meeting this threshold.

Resources:

Birnbaum, D. Analysis of hospital infection surveillance data. *Infection Control* 1985; 5:332-338.

Lyon, J. Introduction to Epidemiology, 1986. University of Utah, pp. 1-36.

McGeer A, Campbell B, Emori TG, et al., "Definitions of infection for surveillance in long-term care facilities," *The American Journal of Infection Control*, 1991;1 -7.

Rusnak, P. and Horning, L. Surveillance in the long-term care facility in Smith P (ed): *Infection Control in Long-term Care Facilities*, 2nd ed. New York, Delmar, pp. 117-130.

Satterfield, N. Infection control in long-term care facilities: the hospital-based practitioner's role. *Infection Control and Hospital Epidemiology* 1993;14:40-47.

Definitions of Infection for Surveillance in Long-Term Care Facilities

Reproduced from McGeer A, Campbell B, Emori TG, et al., "Definitions of infection for surveillance in long-term care facilities," **The American Journal of Infection Control, 1991;1 -7 with permission from Mosby-Year Book, Incorporated.*

Allison McGeer, MD
Beverly Campbell, RN
T. Grace Emori, RN
Walter J. Hierholzer, MD
Marguerite M. Jackson, RN
Lindsay E. Nicolle, MD
Carla Peppler, RN
Amersolo Rivera, RN
Debra G. Schollenberger, RN
Andrew E. Simor, MD
Phillip W. Smith, MD
Elaine E-L. Wang, MD
Toronto, Ontario, Canada

In the last decade, increasing attention has focused on the practice of infection control in long-term care facilities. It has become clear that much more data on rates, risk factors, and management of infections in residents of such facilities are needed if the quality of resident care and the cost-effectiveness of infection control programs are to be optimized. It is also clear that the standard definitions of nosocomial infections developed for use in acute care hospitals are not applicable in most long-term care facilities. Standard definitions of infections for use in long-term care facilities would be helpful, both as guidelines for surveillance and as outcome measures for studies of infections and infection control in these facilities.

This set of definitions was developed at a consensus conference held in January 1989 and subsequently revised by a modified Delphi technique involving consensus conference participants. Discussion at the conference was based on definitions developed at Yale University (Checko P, et al., unpublished manuscript) and revised by the Co-operative Infection Control Committee and on detailed reviews of these definitions written by a sample of 62 infectious disease physicians, geriatricians, infection control practitioners from long-term care facilities, and authors of published research in the field. They are intended specifically for use in facilities that provide homes for elderly residents who require 24-hour personal care under professional nursing supervision. The majority of these residents will have some degree of cognitive impairment. All will require some assistance with activities of daily living, and some may require urinary catheters, sterile dressings, and/or tube feedings. However, neither intravenous therapy nor laboratory/radiology facilities will usually be available on the premises.

We have no data as yet on the reliability or validity of these definitions, although they are the subject of an ongoing study. We hope, however, that they will stimulate thought and research, and

we look forward to the development of uniform definitions and of infection surveillance and control programs in long-term care facilities.

Principles

The definitions presented here are not all-inclusive. They focus on infections for which surveillance is expected to be useful (i.e., infections that are common and can be acquired and detected in the facility). Three important conditions apply to all of the definitions:

1. All symptoms must be new or acutely worse. Many residents have chronic symptoms, such as cough or urinary urgency, that are not associated with infection. However, a change in the resident's status is an important indication that an infection may be developing.

2. Noninfectious causes of signs and symptoms should always be considered before a diagnosis of infection is made.

3. Identification of infection should not be based on a single piece of evidence. Microbiologic and radiologic findings should be used only to confirm clinical evidence of infections. Similarly, physician diagnosis should be accompanied by compatible signs and symptoms of infection.

Respiratory tract infection

Common cold syndromes/pharyngitis. The resident must have at least two of the following signs or symptoms: (a) runny nose or sneezing, (b) stuffy nose (i.e., congestion), (c) sore throat or hoarseness or difficulty in swallowing, (d) dry cough, (e) swollen or tender glands in the neck (cervical lymphadenopathy).

Comment. Fever may or may not be present. Symptoms must be new, and care must be taken to ensure that they are not caused by allergies.

Influenza-like illness. *Both* of the following criteria must be met:

1. Fever ($\geq 38^{\circ}C$)[1]

2. The resident must have at least three of the following signs or symptoms: (a) chills, (b) new headache or eye pain, (c) myalgias, (d) malaise or loss of appetite, (e) sore throat, (f) new or increased dry cough.

[1]A single temperature of $\geq 38^{\circ}$ C, taken at any site.

Comment. This diagnosis can be made only during influenza season (November to April in Canada). If criteria for influenza-like illness and another upper or lower respiratory tract infection are met at the same time, only the diagnosis of influenza-like illness should be recorded.

Pneumonia. *Both* of the following criteria must be met:

1. Interpretation of a chest radiograph as demonstrating pneumonia, probable pneumonia, or the presence of an infiltrate. If a previous radiograph exists for comparison, the infiltrate should be new.

2. The resident must have at least two of the signs and symptoms described under "other lower respiratory tract infections."

Comment. Noninfectious causes of symptoms must be ruled out. In particular, congestive heart failure may produce symptoms and signs similar to those of respiratory infections.

Other lower respiratory tract infection (bronchitis, tracheobronchitis). The resident must have a least three of the following signs or symptoms: (a) new or increased cough, (b) new or increased sputum production, (c) fever ($\geq 38^{\circ}C$), (d) pleuritic chest pain, (e) new or increased physical findings on chest examination (rales, rhonchi, wheezes, bronchial breathing), (f) one of the following indications of change in status or breathing difficulty: new/increased shortness of breath *or* respiratory rate >25 per minute *or* worsening mental or functional status.[1]

Comment. This diagnosis can be made only if no chest film was obtained or if a radiograph failed to confirm the presence of pneumonia.

Urinary tract infection

Urinary tract infection includes only symptomatic urinary tract infections. Surveillance for asymptomatic bacteriuria (defined as the presence of a positive urine culture in the absence of new signs and symptoms of urinary tract infection) is not recommended, as this represents baseline status for many residents.

Symptomatic urinary tract infection. *One* of the following criteria must be met:

1. The resident does not have an indwelling urinary catheter and has at least three of the following signs and symptoms: (a) fever ($\geq 38^{\circ}C$) or chills, (b) new or increased burning pain on urination, frequency or urgency, (c) new flank or suprapubic pain or

[1]Significant deterioration in the resident's ability to carry out the activities of daily living or in the resident's cognitive status, respectively.

tenderness, (d) change in character of urine,[1] (e) worsening of mental or functional status (may be new or increased incontinence).

2. The resident has an indwelling catheter and has at least two of the following signs or symptoms: (a) fever (≥38°C) or chills, (b) new flank or suprapubic pain or tenderness, (c) change in character of urine,[2] (d) worsening of mental or functional status.

Comment. It should be noted that urine culture results are not included in the criteria. However, if an appropriately collected and processed urine specimen was sent *and* if the resident was not taking antibiotics at the time, then the culture must be reported as either positive or contaminated.

Because the most common occult infectious source of fever in catheterized residents is the urinary tract, the combination of fever and worsening mental or functional status in such residents meets the criteria for a urinary tract infection. However, particular care should be taken to rule out other causes of these symptoms. If a catheterized resident with only fever and worsening mental or functional status meets the criteria for infection at a site other than the urinary tract, only the diagnosis of infection at this other site should be made.

Eye, ear, nose, and mouth infection

Conjunctivitis. *One* of the following criteria must be met:

1. Pus appearing from one or both eyes, present for at least 24 hours.

2. New or increased conjunctival redness, with or without itching or pain, present for at least 24 hours (also known as "pink eye").

Comment. Symptoms must not be due to allergy or trauma to the conjunctiva.

Ear infection. *One* of the following criteria must be met:

---

[1]Change in character may be clinical (e.g., new bloody urine, foul smell, or amount of sediment) or as reported by the laboratory (new pyuria or microscopic hematuria). For laboratory changes, this means that a previous urinalysis must have been negative.

[2]Change in character may be clinical (e.g., new bloody urine, foul smell, or amount of sediment) or as reported by the laboratory (new pyuria or microscopic hematuria). For laboratory changes, this means that a previous urinalysis must have been negative.

1. Diagnosis by a physician[1] of any ear infection.

2. New drainage from one or both ears. (Nonpurulent drainage must be accompanied by additional symptoms, such as ear pain or redness.)

Mouth and perioral infection. Oral and perioral infections, including oral candidiasis, must be diagnosed by a physician or a dentist.

Sinusitis. The diagnosis of sinusitis must be made by a physician.

Skin infection

Cellulitis/soft tissue/wound infection. *One* of the following criteria must be met:

1. Pus present at a wound, skin, or soft tissue site.

2. The resident must have four or more of the following signs or symptoms: (a) fever (>38°C) or worsening mental/functional status; *and/or*, at the affected site, the presence of new or increasing (b) heat, (c) redness, (d) swelling, (e) tenderness or pain, (f) serous drainage.

Fungal skin infection. The resident must have both (a) a maculopapular rash and (b) either physician diagnosis or laboratory confirmation.[2]

Herpes simplex and herpes zoster infection. For a diagnosis of cold sores or shingles, the resident must have both (a) a vesicular rash and (b) either physician diagnosis or laboratory confirmation.

Scabies. The resident must have both (a) a maculopapular and/or itching rash and (b) either physician diagnosis or laboratory confirmation.

Comment. Care must be taken to ensure that a rash is not allergic or secondary to skin irritation.

---

[1]Requires a written note or a verbal report from a physician specifying the diagnosis. Usually implies direct assessment of the resident by a physician. An antibiotic order alone does not fulfill this criterion. In some homes, it may be appropriate also to accept a diagnosis made by other qualified clinicians (e.g., nurse practitioner, physician associate).

[2]For *Candida* or other yeast, laboratory confirmation includes positive smear for yeast or culture for *Candida* sp.; for herpetic infections, positive electron microscopy or culture of scraping or swab; for scabies, positive microscopic examination of scrapings.

Gastrointestinal tract infection

Gastroenteritis. *One* of the following criteria must be met:

1. Two or more loose or watery stools *above what is normal* for the resident within a 24-hour period.

2. Two or more episodes of vomiting in a 24-hour period.

3. Both of the following: (a) a stool culture positive for a pathogen (*Salmonella, Shigella, E. coli* O157:H7, *Campylobacter*) or a toxin assay positive for *C. difficile* toxin and (b) at least one symptom or sign compatible with gastrointestinal tract infection (nausea, vomiting, abdominal pain or tenderness, diarrhea).

Comment. Care must be taken to rule out noninfectious causes of symptoms. For instance, new medications may cause both diarrhea and vomiting; vomiting may be associated with gallbladder disease.

Systemic infection

Primary bloodstream infection. *One* of the following criteria must be met:

1. Two or more blood cultures positive for the same organism.

2. A single blood culture documented with an organism thought not to be a contaminant *and* at least one of the following: (a) fever ($\geq$38°C), (b) new hypothermia (<34.5°C, or does not register on the thermometer being used), (c) a drop in systolic blood pressure of >30 mm Hg from baseline, or (d) worsening mental or functional status.

Comment. Bloodstream infections related to infection at another site are reported as secondary bloodstream infections and are not included as separate infections.

Unexplained febrile episode. The resident must have documentation in the medical record of fever ($\geq$38°C) on two or more occasions at least 12 hours apart in any 3-day period, with no known infectious or noninfectious cause.

COMMENTARY

The identification of infections in residents of long-term care facilities is often difficult, and several of these definitions may be found to lack sufficient validity and/or reliability for use in many surveillance programs. Because there is a general consensus of both conference participants and written reviewers as to those definitions and criteria that are likely to cause the most difficulty, the conference discussion surrounding these areas is summarized here.

General

These definitions do not specify the location of the resident (community, facility, acute care hospital) at the time the infection was acquired. A definition of "facility-associated" analogous to the CDC's definition for *nosocomial*[2] would be that, for an infection to be facility-associated, there must be no evidence that the infection was present or incubating on admission or readmission (after hospitalization or community visit) and no evidence that the infection began as the result of a procedure carried out in an acute care hospital or a physician's office. The utility of classifying infections on the basis of this definition remains to be tested.

Fever has been defined as at least one temperature, taken at any side, of 38°C or more. Prospective studies disagree on the proportion of elderly persons with significant systemic infections who mount a fever of this magnitude.[3-5] Other studies have suggested that the range of normal temperature is wider for the elderly than for younger adults and that, for some residents, temperatures of less than 38°C may be abnormally high.[6,7] Most conference participants would have preferred a definition based on a temperature increase of 1° or a 1.5°C above baseline for the resident, and some believed that differentiation between axillary, oral, and rectal temperatures would be desirable. However, there was no consensus as to what would constitute an adequate baseline (for instance, what the number or timing of baseline measurements should be). In addition, participants were not confident that such temperatures should be recorded consistently and were concerned that if oral or axillary temperatures were taken with mercury thermometers they might be unreliable.[8] These considerations led to a decision to use the simplest definition, recognizing that the consequences of that decision must be evaluated.

For those infections that occur most often as outbreaks (e.g., gastroenteritis, influenza), consideration was given to a criterion requiring similar illness in a specified number of other residents or staff. This was advanced because of concerns that the definitions as written are not sensitive enough to detect mild cases of viral gastroenteritis or influenza but that the result of relaxing the criteria would be definitions that were not specific enough to avoid mislabeling of noninfectious symptoms as infections. However, a requirement that a certain number of infections be present for any one to be reported would make surveillance more complicated. Further, most participants thought that consideration of clustering was more appropriately incorporated into the analysis of the collected data. This criterion was thus not included.

Some infections such as herpes zoster and oral candidiasis, can be reliably diagnosed on clinical grounds by an experienced observer. Because staff members in some long-term care institutions may not have sufficient training to be able to make these diagnoses, and because there is no simple measure of the experience required, "diagnosis by a physician" became the relevant criterion for these infections. However, the experience of the observer is recognized as more important than the particular qualification.

The conference participants had some difficulty in agreeing on a precise requirement for "diagnosis by a physician," although the consensus was that is should usually imply direct physical assessment of the resident. Most participants thought that acceptance of a diagnosis based on a telephone conversation or an order for antibiotics would result in overdiagnosis of infections but that requiring chart documentation would result in substantial underdiagnosis. The current definition is a compromise and must be validated. Similarly, in facilities in some geographic areas, clinicians other than physicians (e.g., nurse practitioners, physician associates) may be equally able to diagnose infections. However, because their availability and training is geographically variable, "physician" has been retained in the definition, with the comment that individual infection control committees may wish to define diagnosis by other clinicians as acceptable for their institutions.

Specific

There was considerable disagreement as to the value of including a definition that attempted to capture influenza. Influenza is a significant cause of morbidity and mortality and intervention early in an outbreak may prevent new cases. However, influenza cannot be diagnosed reliably on clinical grounds, and, because of the explosive nature of many outbreaks, the effectiveness of surveillance is not clear. Participants debated two strategies for recognition of influenza: (a) a statement that, during influenza season, any cluster of febrile respiratory illness should be suspected of being influenza and (b) a case definition. Although there was no consensus as to the preferable strategy, a definition of "influenza-like illness" was developed, with the intention of providing a case definition whose utility could be tested.

There was a consensus that pneumonia could not be differentiated from other lower respiratory tract infections without radiographs of the chest. Thus the definition of pneumonia requires radiologic examination. Participants agreed that misclassification of some cases of pneumonia as "other lower respiratory" infections will result, but they did not believe that such errors were a serious concern for infection control purposes. Results of blood tests, such as the white blood cell count, were considered as criteria, but there was a general consensus that these would be available to rarely to justify inclusion. Isolation of a pathogen from sputum was also considered as a criterion but was rejected. In general, although culture of a pathogen may help to identify the etiologic agent of a pneumonia and guide antimicrobial therapy, culture results are not helpful in determining the presence or absence of infection.[9,10] In addition, the frequency with which adequate specimens can be obtained in this population is low.[11,]

Asymptomatic bacteriuria has not been included in the definitions. The prevalence of asymptomatic bacteriuria in institutionalized elderly persons is high.[13] Available evidence suggests that it is not an independent predictor of mortality,[14, 15] that treatment does not eradicate it in the majority of patients,[16] and that treatment to prevent infection is not completely effective and is associated with significant side effects.[17] Participants thought that surveillance for asymptomatic bacteriuria would not be useful. The known high prevalence of bacteriuria in this population also led to the decision to use urine culture results as a condition rather than as a criterion. Tests for pyuria were considered as criteria but were rejected as being reliably predictive of neither bacteriuria nor symptomatic infection in this population.[18, 19]

Because laboratory confirmation of fungal infections and scabies is often unavailable, consideration was given to a criterion involving response to specific therapy. This was rejected because the appearance of rashes caused by these infections may be non-specific and because spontaneous resolution of noninfectious rashes may occur in the length of time that would be considered "response to therapy."

Although surgical wound infections may be included in the category of cellulitis/soft tissue/wound infections, it will usually be possible to use current CDC definitions for their diagnosis. The CDC definitions should take precedence, and the infections should be attributed to the acute care facility in which they were acquired.

Most participants had significant reservations about the definition of gastroenteritis. Participants generally thought that because gastrointestinal symptoms are common, and viral gastroenteritis is often a mild disease, any definition that captured most viral gastroenteritis would also label many noninfectious episodes as infections. There was concern that such a definition would also label as infected residents who were carriers of *Salmonella* spp. or *Clostridium difficile* and who had mild, noninfectious gastrointestinal symptoms. It is hoped that the results of studies currently under way will be of help in improving the surveillance definition.

Because most residents who have bloodstream infections will be ill enough to require transfer to an acute care hospital before the diagnosis of bloodstream infection is made, bloodstream infections will be diagnosed infrequently in most long-term care facilities. In general, when an infection related to the facility is diagnosed in the hospital, the facility should include the infection in its surveillance data, but the CDC's definition of nosocomial infection should be used.[2] However, since blood cultures might be obtained in some institutions, a definition was included. The definition is somewhat more stringent than the CDC definition of nosocomial infection in that laboratory confirmation is required (i.e., two positive blood cultures or one positive blood culture and a relevant symptom).[2]

The clinical criteria accompanying the single positive blood culture are not intended to be all-inclusive symptoms of sepsis. Rather, it was thought that any resident who had true sepsis would meet at least one of the criteria. Note that "hypothermia" is defined arbitrarily and that it must be "new" because some elderly residents who are well may have low baseline temperatures.

Several participants thought that adequate evaluations of residents should yield a site of infection in all episodes that are truly infectious and that noninfectious febrile episodes would most often be of trivial significance. The category of "unexplained febrile episode" has been retained to allow testing of these hypotheses. If they are correct, the definition may be useful for the detection of lack of adequate assessment of febrile residents.

In summary, these definitions are consensus definitions from conference participants. Some of them will likely need to be improved when more data on their performance become available. Individual institutions may also wish to modify them to suit their particular resident populations and physician and laboratory availability. These definitions will also be of limited use in outbreak investigation, since a case definition specific to each outbreak must be developed. We hope, however, that they will provide a basis for the development of standardized definitions and stimulate further research into infection control in long-term care facilities.

References

1. Co-operative Infection Control Committee (Peppler C, Campbell B, Prince K, Rivera A, Scully D). A surveillance protocol for long term care facilities. Markham, Ontario, Canada: Ontario Nursing Home Association, 1988:8-14.

2. Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC Definitions for nosocomial infections, 1988. Am J Infect Control 1988;16:128-40.

3. McAlpine CH, Martin BJ, Lennox IM, Roberts MA. Pyrexia in infections in the elderly. Age Ageing 1986;15:230-4.

4. Berman P, Hogan DB, Fox RA. The atypical presentation of infection in old age. Age Ageing 1987;16:201-7.

5. Castle S, Yeh M, Miller D, Norman D. Fever response in elderly nursing home residents. Clin Res 1990;30:80A.

6. Howell TH. Oral temperature range in old age. Gerontol Clin (Basel) 1978;17:133-6.

7. Williams BT. Oral temperatures of elderly applicants for welfare services. Geront Clin (Basel) 1968;10:281-7.

8. Downton JH, Andrews K, Puxty JAH. "Silent" pyrexia in the elderly. Age Ageing 1987;16:41-4.

9. Lentino JR, Lucks DA. Nonvalue of sputum culture in the management of lower respiratory tract infections. J Clin Microbiol 1987;25:756-62.

10. Gleckman R, Devita J, Hibert D, Pelletier C, Martin R. Sputum gram stain assessment in community-acquired bacteremic pneumonia. J Clin Microbiol 1988;26:846-9.

11. Marrie TJ, Durant H, Kwan C. Nursing home acquired pneumonia. J Am Geriatr Soc 1986;34:697-702.

12. Peterson PK, Stein D, Guay DRP, Logan G, et al. Prospective study of lower respiratory tract infections in an extended-care nursing home program. Am J Med 1988;85:165-71.

13. Kaye D. Urinary tract infections in the elderly. Bull NY Acad Med 1980;56:209-20.

14. Nicolle LE, Henderson E, Bjornson J, MacIntyre M, Harding GKM, MacDonell JA. The association of bacteriuria with resident characteristics and survival in elderly institutionalized males. Ann Intern Med 1987;106:682-6.

15. Kunin CM, Chin QF, Chambers S. Morbidity and mortality associated with indwelling catheters in elderly patients in a nursing home— confounding due to the presence of associated diseases. J Am Geriatr Soc 1987;35:1001-6.

16. Nicolle LE, Mayhew JW, Bryan L. Outcome following antimicrobial therapy for asymptomatic bacteriuria in elderly women resident in an institution. Age Ageing 1987;17:187-92.

17. Nicolle LE, Mayhew WJ, Bryan L. Prospective randomized comparison of therapy and no therapy for asymptomatic bacteriuria in institutionalized elderly women. Am J Med 1987;83:27-33.

18. Flanagan PG, Davies EA, Rooney PG, Stout RW. Evaluation of four screening tests for bacteriuria in elderly people. Lancet 1989;1:1117-9.

19. Boscia JA, Abrutyn E, Levison ME, Pitsakis PG, Kaye D. Pyuria and asymptomatic bacteriuria in elderly ambulatory women. Ann Intern Med 1989;110:404-5.

Editor's Note:

Adopting definitions that are objective in nature (by meeting specific criteria) are an essential component of an infection control program. These definitions are not mandated but are intended to provide a basic outline of criteria for infections in the long-term care resident. Some practitioners have reported that use of these definitions has improved their ability to measure outcomes of their infection control program.

Some ICP's who have adopted and utilized these definitions have described difficulty in meeting the criteria for infection (particularly for UTI) and thus have adapted the definition to make it workable in their facilities. The infection control committee should formally adopt the definitions for infection that will be used in your facility.

INFECTION CONTROL LINE LISTING

adapted with permission from Caryl Collier, RN, MPH, CIC and the Missouri Department of Health Consensus Committee on Prevention and Control for Multiply-resistant Organisms, 1992

UNIT _____ MONTH _____ AVG. DAILY CENSUS _____

RESIDENT NAME	ROOM	SEX		AGE	INFECTION SITE					DATE OF CULTURE/ PATHOGEN	DATE OF ONSET OF SYMPTOMS	DATE TREATMENT BEGAN/RX	RISK FACTORS	ANTIBIOTIC RESISTANT		DATE RESOLVED
		M	F		URI	LRI	UTI	SKIN	OTH					YES	NO	
TOTALS																

TOTAL RESIDENT DAYS FOR MONTH _____

Reprinted from the Utah Department of Health, Division of Health Systems Improvement, Bureau of Health Facility Licensure, Nursing Care Facility Rules R432-150-25. Adopted 3/5/95.

Infection Control.

(1) Infection Control Committee. There shall be an Infection Control Committee composed of the administrator, medical director/advisory physician, director of nursing services, staff or consulting pharmacist, and, when appropriate, the building engineer or director of maintenance. Representatives from each service offered by the facility shall be available as consultants.

(2) The Committee shall:
- (a) Adopt a definition of nosocomial infections;
- (b) Develop and implement a system to investigate, report, evaluate, and maintain records of infections among residents and personnel;
- (c) Establish uniform cleaning, disinfecting, and sterilization practices and techniques to include:
  - (i) Care of utensils, instruments, solutions, dressings, articles and surfaces;
  - (ii) Resident contact techniques including handwashing before and after resident care;
  - (iii) Criteria and procedures for isolating residents;
  - (iv) Care of urinary catheters, intravenous catheters, respiratory therapy equipment, and other devices that provide an entry portal for pathogenic microorganisms;
  - (v) Regimen to prevent and treat decubitus ulcers;
  - (vi) Selection, storage, use, and disposition of disposable resident care items;
  - (vii) Selection, storage, use, and disposition of hypodermic needles;

(3) Develop criteria to determine if an employee has a communicable disease or conditions that may interfere with adequate job performance;

(4) Review written reports of state and local sanitary inspectors;

(5) Promptly notify the administrator and local and state health authorities when there is an unusual or high incidence of infectious disease.

(6) Preventing Spread of Infection.
- (a) When a resident has a condition that requires use of isolation techniques to prevent the spread of infection to other staff and residents within the facility, the facility shall adopt the isolation technique to be used to prevent the spread of infection or disease within the facility.
- (b) The facility shall prohibit employees with a communicable disease or open skin lesions, or weeping dermatitis from contact with residents, their personal or resident care items, or their food, if contact may result in the transmission of the infection or disease.
- (c) Facility staff shall wash their hands before and after each prolonged and intense resident contact, after removing personal protective equipment, after using equipment, after using the restroom, before any food handling including assisting or feeding a resident and after contact with any item contaminated by a residents body substance.
- (d) The facility shall ensure adherence to accepted professional practice for universal precautions. The CDC's Guidelines for universal precautions is one recommended source of practice.
- (e) The facility shall be in compliance with the Occupational Safety and Health Administrations Bloodborne Pathogen Standard.

(7) Linens.
Personnel shall handle, store, process, and transport linens so as to prevent the spread of infection.